

Branch Name:	Mechanical Engineering
Semester/Year:	Semester V / Third Year
Subject Title:	Theory of Machines
Subject Code:	1ET1010502
Pre-requisite:	Elements of Mechanical Engineering, Kinematics of Machines

Course Objectives:

1. To develop a solution oriented approach by in depth knowledge of Theory of Machines.
2. To address the underlying concepts, methods and application of different machines.

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
03	00	02	04	70	30	30	20	150

Subject Contents			
Sr. No	Topic	Total Hours	Weightage (%)
1	Friction Devices : Clutches, Brakes and Dynamometers Clutches :- Introduction, Classification of clutches, Torque transmission capacity, Consideration for uniform wear and uniform pressure theory, Single plate and multi plate clutch, Centrifugal clutch. Brakes :- Introduction, Classification of brakes, Mechanical Brakes – Shoe brake, Band brake, Band and block brake, Internal expanding shoe brake, Braking of vehicle. Dynamometers: - Introduction, Absorption and transmission type.	12	30
2	Gyroscope: Concept of gyroscope, Angular acceleration, Gyroscopic effect in Airplanes, Ships and Rotor, Stability of two wheeled and four wheeled vehicle.	6	15
3	Flywheels: Function, Construction, Flywheel's rim and dimensions, Coefficient of fluctuation of energy and speed, Turning moment diagram, Operation of flywheel in a punching machine.	4	10
4	Governors: Introduction, Function and types of governors, Centrifugal governors, Watt governor, Porter governor, Proell governor, Hartnell governor, Characteristics of governor – Stability, Sensitivity, Isochronism, Hunting, Concept of control force, Effort and power of governor.	6	15

5	Introduction to Synthesis of Mechanisms: Introduction of synthesis, Types of synthesis, Synthesis of a four bar chain, Freudenstein's equation for four bar mechanism, Precision point for function generator (Chebychev spacing method), Bloch method.	6	15
6	Inertia forces in reciprocating parts: Introduction, D'Alembert's Principle, Radius of gyration of rigid bodies – Simple pendulum, Compound pendulum, Bifilar suspension, Trifilar suspension, Dynamically equivalent system, Force analysis in IC engine mechanism – Static force analysis, Dynamic force analysis.	6	15

Course Outcomes:

The student will be able to

1. Design and analyze clutches and brakes.
2. Analyze effect of gyroscopic couple on vehicles, ships, and aero planes.
3. Design flywheels for IC engines and punching press.
4. Understand the application of synthesis of mechanism by analysis of various mechanisms by using graphical and analytic methods.
5. Apply fundamentals of static and dynamic analysis to various mechanical systems.

List of Reference Books:

1. Rattan, Sarjit S. Theory of machines. Tata McGraw-Hill Education, 2014.
2. Singh, Sadhu. Theory of machines. Pearson Education India, 2006.
3. Uicker, John Joseph, Gordon R. Pennock, and Joseph Edward Shigley. Theory of machines and mechanisms. Vol. 1. New York, NY: Oxford University Press, 2011.
4. Waldron, Kenneth J., Gary L. Kinzel, and Sunil K. Agrawal. Kinematics, dynamics, and design of machinery. John Wiley & Sons, 2016.
5. A G Ambekar, Mechanism and Machine Theory, PHI.
6. R L Norton, Kinematics and Dynamics of Machinery, McGraw-Hill.
7. Meriam, J L and Kraige, L G, Engineering Mechanics: Dynamics, Wiley.

Note: Use of Design data book during the Lectures/Practical sessions is desirable.

List of Practicals:

1. To demonstrate different types of Brakes to calculate braking effort.
2. To demonstrate different types of clutch.
3. Power measurement using dynamometers.
4. To demonstrate & perform gyroscope evaluation.
5. To demonstrate flywheel and its effect on dynamic of system.
6. To demonstrate & perform gravity control governors evaluation.
7. To demonstrate & perform spring control governors evaluation.
8. To study about synthesis of mechanism by analytical and graphical method.
9. To determine the radius of gyration of a compound pendulum.
10. To determine the radius of gyration of a body (bar) using Bi-filer suspension.
11. To determine the radius of gyration of disc using Tri-filer suspension.

E-Resources:

1. <http://nptel.ac.in/courses/112104114/7>
2. <http://nptel.ac.in/courses/112104114/16>
3. <http://nptel.ac.in/courses/112104121/>